DOCUMENT RESUME

ED 358 323 CE 063 872

AUTHOR	Cappelli, Peter
TITLE	College and the Workplace: How Should We Assess Student Performance? EQW Working Papers.
INSTITUTION	National Center on the Educational Quality of the Workforce, Philadelphia, PA.
SPONS AGENCY	Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE	92
CONTRACT	R117Q00011-91
NOTE	20p.
PUB TYPE	Information Analyses (070)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Academic Achievement; Adult Education; College Graduates; College Students; Competence; Educational Testing; *Education Work Relationship; *Grades (Scholastic); Grading; Higher Education; *Job Analysis; *Job Performance; *Job Skills; Predictive Validity; Student Behavior; *Student Evaluation; Success

ABSTRACT

The fact that college grades are poor predictors of future job performance is a cause for concern. A more important issue is assessment, for course grades cannot measure many of the work-relevant skills that a college education provides. Selection tests are one effort to identify and establish those characteristics of applicants that predict future job success. If classroom grades could be broken down to reveal performance in such areas as verbal ability or memory, they would be indicative of subsequent job performance because they would essentially duplicate ability tests; ability tests, however, are typically three to four times better at predicting job performance. Another way to obtain information on a job candidate is through what is called "bio-data"; detailed information on extracurricular activities may reveal knowledge, skills, and abilities (KSAs) acquired by a student outside traditional classroom settings. Many colleges experiences provide what is the equivalent of work sample tests. Another way to get at the question of what predicts job success is to look directly at the requirements of jobs. Job analysis refers to systematic efforts to collect information about the work requirements associated with particular jobs. Job analyses either focus descriptions on the job and tasks performed or are written from the perspective of the worker and describe the KSAs required. The basic sets of KSAs could be developed more thoroughly in college instruction. The greatest improvements in assessment could be made by simply assembling existing information about student performance in more innovative ways. An appendix provides descriptions of some of the most widely used job analysis systems and identifies the KSAs that are stressed in them. (Contains 17 endnotes and 32 references.) (YLB)

EQW WORKING PAPERS

ED358323

College and the Workplace: How Should We Assess Student Performance?

by Peter Cappelli

Co-Director
National Center on the Educational Quality
of the Workforce
University of Pennsylvania

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

CE063872

"College and the Workplace: How Should We Assess Student Performance?"
by Peter Cappelli
EQW Catalog Number: WP09

The work reported herein was supported under the Educational Research and Development Center program, agreement number R117Q00011-91, CFDA 84.117Q as administered by the Office of Educational Research and Improvement, U.S. Department of Education. The findings and opinions expressed in this report do not reflect the position or policies of the Office of Educational Research and Improvement or the U.S. Department of Education.

Materials for this paper were presented as a background paper on Goal Five for the U.S. Department of Education's National Center on Educational Statistics.

Copyright © 1992 by the Trustees of the University of Pennsylvania

Contents

Introduction 1

The Relationship between Educational and Job Performance 2

What Can We Learn from Industry Practices? 4

Ability Tests 4

Bio-Data 5

Work Samples 5

Summary 6

Job Analysis 6

Conclusions on Improving College Assessments ... 9

Appendix A 11

Job Analysis Systems and KSAs 11

Endnotes 13

References 14

I. Introduction

The rising cost of higher education and serious concerns about the relationship between student learning and the strength of the national economy have made the performance of college students an issue for public policy. One objective set by the National Education Goals Panel (NEGP) is to develop a method of assessing the performance of college graduates, a task that reflects a growing concern that college students are not learning "enough" for the good of the nation. Disenchantment with traditional assessment methods already has caused a wave of experimentation among secondary schools[1]—the time has come for similar experiments at the college level.

The related NEGP goal of strengthening the link between education and the workplace can also be served by an assessment of student performance. The experience that the business community has accrued in identifying the skills required for college-level jobs and in testing employees to predict their employment success can play a valuable role in the effort. While improving job performance is just one of many important goals for education, it is increasingly important because we can now see more clearly the strong links between individual job performance and the national economy. The evidence suggests that education at the college level may not be serving this goal—and that doing so would not impinge on other important objectives of education.

II. The Relationship Between Educational and Job Performance

In order to determine the relationship between educational performance and job performance, two initial questions must be considered: What effect does one's educational performance have on job performance? What aspects of education are most important in producing effective employees?

John Bishop surveyed economics research and concluded that performance in high school explains almost nothing about job success. Although a high school diploma is an important credential, superior performance in school, when defined as earning high grades, does not improve the probability of getting a job nor of receiving higher wages once one has a job (Bishop 1989). Most of this research is based on data from the National Longitudinal Sample (NLS), which tracked over time a cohort of high school graduates. On the college level, the NLS-based research on the relationship between performance in college and on the job has been complicated by difficulties in coding transcript data, and the results are not always consistent. College grades from this data set, however, also do not appear to be good predictors of securing jobs or of the level of wages.

The other area of research on the subject, performed mainly by industrial psychologists, is more extensive and typically uses actual measures of job performance (as opposed to indirect measures; e.g., wages) to measure worker success. In this field, it has been argued for decades that college grades are not good predictors of actual performance on the job (McClelland 1973). Although some studies do find a relationship between grades and measures of job performance within individual firms, it is remarkable just how many published studies report no relationship. This is especially surprising given that it is not a common practice of researchers to publish studies that show an *absence* of significant relationships and that journals typically are not interested in such reports.[2] Robert Bretz (1989) performed one of the more recent meta-analyses/statistical summaries of previous grade point average research, using a large sample of studies, and found no overall relationship with adult achievement in the workplace. David Dye and Martin Reck (1989) used a similar sample of studies. They controlled for sampling error and unreliability of criterion measure in the original series through a series of corrections. They reported a significant, albeit very small, validity coefficient of 0.18. (Validity coefficients are correlations, and their square is the coefficient of determination—the popular R2 measure. Dye and Reck's 0.18 correlation, for example, means that grades explain 0.032 percent of the variance in job performance measures, which is not a lot.)[3]

Even the proponents of using grades as predictors claim only that grades have *some* relevance, and not that they are powerful predictors in the absolute sense. It is easy to find studies in almost every context that find no relationship between grade point average and performance: in business, using overall measures of job success (e.g., Ferris 1982); in engineering (e.g., Muchinsky and Hoyt 1973); and in

performance in graduate programs (e.g., Harrell and Harrell 1984, cited in Howard 1986). Even the quality of the college, measured by its selectivity in admissions, has been shown to add little to predictions of job performance (e.g., Ferris 1982; Howard 1986; Rosenbaum 1984). Perhaps the most successful attempt to find a relationship between grades and job performance was the study at AT&T by Howard (1986). The project used employee-ability data from assessment centers (which created simulations to proxy job performance) as an indirect measure of job performance. Howard found that undergraduate grades have statistically significant relationships with only about one-fourth of the measures of job performance and potential.

Reviewers of all categories of selection procedures, such as Reilly and Chao (1982) and Hunter and Hunter (1984), assert that grades, in terms of their predictive power, are well toward the bottom of any ranking of selection devices. Although grades may help determine one's occupation and income (largely through affecting admission to graduate schools), and graduates who receive a college degree (as opposed to simply taking courses) usually earn significantly more, grades and their indication of performance in college are poorly related to actual job performance.[4]

Bishop suggests that one reason for the poor relationship between grades and job performance at the high school level is that employers do not receive transcripts or similar information about school performance and would not be sure how to interpret such information if they did have it. This does not appear to be the case for college grades, however. Anecdotal evidence strongly suggests that college recruiters can get college transcripts and do understand them, especially within professional fields such as engineering and business.

One hypothesis, drawn from the fact that grades are poor predictors of job performance, is that college performance is largely irrelevant to performance in the workplace.[5] An alternative hypothesis is that elements of college performance are relevant and important, but grades are not the relevant indicator. But the fact that grades do function better in predicting performance as the links between education and job content become closer (e.g., in graduate and professional programs) indicates that grades, as currently designed, can be revealing in the right circumstances.[6] Furthermore, it may be that other aspects of college education not usually considered by policymakers may also be relevant to work life. Howard (1986) found, for example, that extracurricular experiences are much better predictors of work performance than are grades.

Whatever the reason, the fact that grades do not predict performance means that employers will not rely on them when making hiring decisions. And if good grades do not "pay off," students who have no plans to enter graduate school will have even less incentive to work hard in their classes. Employers are also harmed. They must rely on expensive alternatives to predict job performance; the greater the error in predicting which graduates will excel in a position, the greater the cost to the economy in terms of performance. In practical terms, in order to strengthen the connection between education and work, we must find assessment devices for student achievement that both measure performance in college and predict performance on the job.

There is another important reason for being concerned about strengthening the relationship between college achievement and job performance. The Supreme Court, in cases such as *Griggs v Duke Power*, found that many criteria used to select employees were based on factors that were not closely associated with job performance. The use of such criteria had a disparate impact on protected groups in society, such as racial minorities, and therefore was unconstitutional employment discrimination. In other words, unless selection criteria can be shown to be valid

predictors of actual job performance, any employer who uses them in employment decisions runs a great risk of being successfully prosecuted for discrimination. Given the poor relationship between grades and job performance, an employer who bases employment decisions on grades is asking for legal trouble—even an employer whose noble goal is only to use job offers as a device to encourage students to work hard in school. The only way to expect employers to use measurements of student performance in hiring decisions is to produce school performance measurements that relate to job performance.

III. What Can We Learn From Industry Practices?

If college grades do not predict job performance, what does? Selection tests are one effort to identify and establish those characteristics of applicants that predict future job success. The selection tests' ability to establish what is important for job success may offer some general recommendations for developing tests to assess college performance.

In this context, selection tests face a difficult mission because it is often hard to define, let alone measure, "superior job performance," and the aspects of performance that lie outside the control of individuals are often powerful in their effects. For employers, any improvement over chance counts as a big success, especially when the costs of the tests are minimal.[7] Most selection procedures do not explicitly test college classroom experiences, with the exception of jobs that require occupation-specific skills, such as accounting.

The selection procedures that make the most explicit use of material associated with college education are described in the following subsections.

Ability Tests

Ability tests are designed to assess how much one has learned about a particular subject or area. They can be subdivided into (1) *achievement tests*, which focus on organized learning (typically classroom instruction of paradigmatic material); and (2) *aptitude tests*, which focus more on informal experiences and information. "Aptitude" is a prediction about future learning, and the argument underlying these tests is that learning is easier when built on a base of even informal information.

The best known and most widely used ability test is the General Abilities Test Battery (GATBy), which may serve to illustrate the standard components of these tests. Developed by the U.S. Employment Service as a screening device, GATBy measures nine basic aptitudes; the first three (the "cognitive composite") are thought to be the most closely associated with college-level jobs: intelligence (general learning ability), verbal aptitude, and numerical aptitude (arithmetic). Tests similar to these are often based on academic classroom material and are correlated with

academic achievement. Gottfredson (in Ash et al. 1989) found a correlation of 0.60 between general intelligence/mental aptitude scores and level of educational achievement.

What is striking about ability tests is that although they are related closely to material that is taught in the classroom, they are typically three or four times better at predicting job performance than course grades, which (presumably) are the more direct measure of classroom performance![8] One possible explanation for this contradiction is that the grades typically available to employers are not broken out in ways that would reveal performance on any of the test items. Verbal aptitude may be measured by the "class participation" component of grades in several courses, but there is no way to parcel out an overall assessment of verbal ability from course grades. Overall grade point averages, on which most studies rely, mask achievement in specific courses in which job-relevant knowledge, skills, and abilities (KSAs) may be measured. Performance in applied math and statistics courses reveal job-relevant math and data skills; architecture and design courses may also reveal a great deal about spatial relations, a key predictor of performance in many occupations.

Bio-Data

Information about a job candidate's background is often referred to as *bio-data*. The theoretical arguments in support of bio-data as a selection device are rooted in notions of consistency: past performance predicts future performance. Overall, bio-data are thought by many to be the best predictors of job performance available.[9] Sometimes, the relationships with performance are straightforward, such as when success in an engineering internship program predicts success as an engineer; but other times, they are less obvious. One of the best-known anecdotes in this field is that the question "Did you ever build a model airplane that flew?" predicted success in flight training almost as well as the entire battery of aptitude tests administered by the U.S. Air Force during World War II.

What bio-data offers is the possibility of assessing KSAs that have been acquired outside of traditional classroom settings or even those KSAs that are acquired in the classroom but not measured by grades. For most adults, college represents an important, fundamental period of development, and it would be remarkable if life experiences during that period did not explain something about later job performance. Howard (1986) found, for example, that one's major subject in college was the best predictor of job performance at AT&T; the next best predictor was participation in more extracurricular activities, with more leadership positions in those activities.

Work Samples

The idea behind work samples is straightforward: to assess whether someone will perform well as a typist—give them something to type. There is little doubt that work samples have the strongest conceptual validity of any selection device because of their clear point-to-point consistency. Asher and Sciarrino (1974) found that in terms of their validity, work samples are a close second to bio-data. Schmitt and colleagues (1984) found strong support for using work samples in their meta-analysis of selection devices. "Assessment centers," a selection method using multiple simulations of real work problems ("in-basket tests" are one popular component), can be thought of as using work sample methods tailored specifically to managerial jobs. "Occupational competency tests," typically paper-and-pencil tests that attempt to get at work sample issues, also do a good job of predicting work performance. Hunter's (1983) meta-analysis suggests that occupational competency tests are twice as effective as ability tests in predicting job performance.

Perhaps the main drawback to using work samples is that it is difficult to design a work sample that could assess the entire range of tasks that a complex job might entail—and assessment center exercises that duplicate this broad range of tasks may be expensive. Work samples also have problems in cases in which candidates need more than entry-level KSAs to perform the job.

Summary

Ability tests, bio-data, and work samples all offer some suggestions for improving assessment of college student performance. If classroom grades could be broken down to reveal performance in areas such as verbal ability or memory, they should be indicative of subsequent job performance because they would essentially duplicate ability tests.

Detailed information on extra-curricular activities (not only membership, but also duties performed, positions held, etc.) are bio-data that may reveal a great deal about the KSAs acquired by a student; these bio-data should be acknowledged more formally by colleges as part of a student's education.

Finally, many college experiences, both in and out of the classroom, provide what is in essence the equivalent of work samples tests. Completing a long research paper, for instance, reveals a great deal about organizational skills, ability to communicate through writing, and knowledge of problem-solving. The ability to run a laboratory experiment from start to finish may measure ability to maintain self-discipline over a long period, level of attention to detail, and ability to analyze data. To get some sense of how rich the information about college experiences could be, consider what it would cost to obtain some of the same information from assessment centers. Indeed, college can be thought of as a 24-hour-a-day assessment center exercise.

IV. Job Analysis

The other way to get at the question of what predicts job success is to look directly at the requirements of jobs. *Job analysis* refers to systematic efforts to collect information about the work requirements associated with particular jobs. The biggest boost given to this analytic approach came from the court cases that tested the validity of selection procedures for employment. The court decisions required that selection be based on actual job requirements, which forced employers to introduce job analyses to determine job content.

Job analyses are really just detailed frameworks for describing jobs. Generally, the same frameworks are used to assess jobs that are filled by high school and college graduates. The various methods of job analyses can be divided into two broad categories: one focuses its descriptions on the job and the tasks performed, and the

other is written from the perspective of the worker and describes the KSAs required. The latter is clearly the more useful for the purposes at hand because it describes what jobs demand from workers.

Appendix A describes some of the most widely-used job analysis systems and identifies the KSAs that are stressed in them. Several requirements are present in virtually every system of job analysis:

1. Interpersonal skills
2. Communication (both oral and written)
3. Critical thinking, broadly defined (problem solving, reasoning, and so forth)
4. Motivation and other personal attitudinal characteristics
5. Working with data and information
6. Math skills

The Secretary's Commission on Achieving Necessary Skills (SCANS) at the U.S. Department of Labor has attempted a similar exercise by identifying the KSAs that are demanded by entry-level jobs in the current economy. The goal was to use these generic job requirements to help develop educational curricula. The SCANS report really amounted to a public-policy-based job analysis and was able to identify entry level job competencies using the following "foundations": basic skills (reading, writing, math, listening, and speaking); thinking skills (creative thinking, decision making, problem solving, visualizing symbols, reasoning, and knowing how to learn); and personal qualities (responsibility, self-esteem, sociability, self-management, and integrity). This list is not dissimilar to the conclusions gained from the job analysis literature.

Job analyses capture what is currently required by jobs and not what will be required in the future. Studies such as *Workforce 2000* (1984) argue that the distribution of jobs in the economy is shifting away from low-skill positions (e.g., manual labor) and toward higher-skill jobs (e.g., engineering). While there is likely to be a shift in this direction, new research suggests that the rate of change will be no greater than in past generations (Cappelli 1991).

Studies that look at changes in current jobs (e.g., how management jobs may differ in the future) are more speculative and are driven mainly by assumptions about how organizations may change. Porter and McKibbin (1988) conducted a study for the American Assembly of Collegiate Schools of Business. Their conclusions, from extensive interviews, suggest that education needs to be more applied, helping students see the links to practice, and that interpersonal and leadership skills should be emphasized and oriented toward managing people. The SEI Center at the Wharton School conducted a similar study to serve as the basis for designing a new business school curriculum. Their recommendations included more extensive training in interpersonal skills, greater integration across disciplines, and more breadth in education (Wind and West [in press]).

Interviews with human resource consultants in firms that specialize in job analyses show a clear consensus opinion that "flatter" organizations (those with less hierarchy) are forcing employees to be more autonomous.[10] The reduction in structure and control associated with this change implies greater reliance on leadership skills as an alternative to managing employees. Communication skills are also becoming more important as employees are assigned more informal reporting arrangements that involve more people, and as matrix organizational structures and team methods of work organization force employees to work more with each other. In general, interpersonal skills become more important as working in teams becomes more prevalent. The ability to be flexible and adapt to new circumstances is another general theme that is driven by the continuing turbulence in modern corporations.

While these speculations suggest that job requirements in the future should place more emphasis on interpersonal skills, the basic set of KSAs will probably differ little from the above list.

It should come as a great relief to those concerned about the potential dominance of education by business to learn that the general KSAs that are identified as necessary for most jobs are not narrow sets of job-specific issues. They are, in fact, basic educational competencies that are compatible with many other objectives of education. More importantly, most are already taught in college, albeit some indirectly. Math skills are developed in math classes and in courses that use applied math. Critical thinking is taught explicitly in logic courses and should be a part of a broad array of courses from history to the social and behavioral sciences. Working with data is explicit in statistics courses and in all branches of the sciences that use applied statistics. Communications should be a part of every course that requires discussion and writing. Interpersonal skills are the subject matter of some courses (e.g., negotiations and group dynamics) and can be developed in any course that requires team projects and in extracurricular programs, such as team sports and organizations. Motivation and personal characteristics, such as integrity, are no doubt the least likely to be taught in a classroom context (although military and religious schools make explicit attempts to develop these characteristics through socialization; and extracurricular activities, such as athletics, may develop them as well).

Suggestions about how these sets of KSAs, which are required in employment, could be developed more thoroughly in college instruction do not need to be revolutionary. Courses in any subject in which students are required to write papers, discuss material, and work in groups go a long way toward developing many of the targeted KSAs. When such courses challenge students to analyze problems and think critically about them, we are more than halfway toward completing the list. Courses that make use of math concepts and data teach students how to apply these factors to problems. Such instruction is contained in an increasingly large proportion of college curricula—math and statistics, all the sciences (natural, behavioral, and social), and often history and anthropology as well.

With this description, it becomes easy to see why grades may not be good predictors of job performance, even for subjects with job-relevant course materials. Consider a hypothetical course in which the material is related directly to employment (such as human behavior), which is taught in a large lecture format in which students talk neither with the instructor nor with each other, and which stresses memorization of the results of prior research. Few job-related skills will be developed in the process of presenting the course material. Multiple-choice tests, which typically are used for grading in such courses, would not reveal a student's ability with these skills, even if they had been developed.

Now, consider the same course taught in a small-group-discussion format with students doing at least some of their work in teams; with the material requiring students to apply theories and statistical methods to real-life problems; and with grades based on written efforts to evaluate course material and on class participation. In the latter situation, the education process develops many useful skills, and the grading procedure can evaluate them. Reports of a recent five-year study at Harvard found that students actually preferred courses with more written assignments and that they performed better when assignments required working in groups.

V. Conclusions on Improving College Assessments

The *fact* that grades are poor predictors of future job performance is a cause for concern. Part of the problem may be that college is simply not teaching the skills for job success, which is especially worrisome because the KSAs necessary for jobs appear to coincide with basic attributes needed in all aspects of life. The good news in this area is that the changes in instruction that will lead to developing important KSAs are straightforward and can be accommodated within existing curricula.

The more important and immediate issue, however, is with assessments. Course grades, the main method for assessing student performance, cannot measure many of the "work-world-relevant" skills that a college education already does provide. Fortunately, experiments in alternative assessment methods are underway. The University of Massachusetts at Boston, for example, requires students to complete an essay exercise at the end of their four-year program, in order to judge their critical thinking abilities. Alverno College in Minnesota may have the most elaborate alternative system. Using assessment center simulations that were designed with help from AT&T's personnel department, Alverno evaluates its students' job-related skills as identified from studies of successful practitioners.

Alternative systems of assessment do not need to be nearly so ambitious. The greatest improvements could be made by simply assembling existing information about student performance in more innovative ways. For example, an overall measure of performance on written material, such as an average grade for all research papers produced by a student during college, would reveal a great deal about written communication skills as well as problem-solving abilities and creativity. Such an indicator requires no new data to construct. The University of Michigan, the College of William and Mary in Virginia, and other colleges have already compiled portfolios of student work over their entire program, a much more difficult task than simply adding up grades. A summary class participation grade across all courses would reveal something similar about verbal communication skills.

Significant student projects, such as semester-long laboratory experiments or group projects, are work samples with direct relevance to job performance, and the assessment of these efforts could be included as part of a student's overall record. Employers already solicit bio-data from students in the form of job applications, although the accuracy of this self-reported information is often questionable. Colleges could help ensure the accuracy of information about school-related extracurricular activities by reporting it as part of a student's record and adding details (e.g., positions held, duties performed, etc.) to highlight its significance. "Project Worklink," run for high schools by the Educational Testing Service, summarizes a student's extracurricular activities and prior work experience and offers transcript data in an effort to provide job-relevant bio-data.

There is every reason for believing that employers would jump at the chance to make use of this repackaged assessment information and that any school providing better job-relevant assessments would have a great competitive advantage in securing employment for its students (at least for those students who perform well!). One of the main reasons given by employers for establishing close ties to professional schools is simply to become familiar with courses, faculty, and extracurricular programs in order to understand the context of student records and identify the best performers. The experience of the Wharton School at the University of Pennsylvania indicates clearly, for example, that employers are interested in close ties—and in donating money—where they believe that those ties will help them to recruit at the school.

We appear to be headed toward the development of a national system for assessing college student performance, a potentially tortuous exercise in which ultimately the goal may become as much to monitor colleges as students.[11] Strengthening the link between education and work, however, requires developing assessments of student performance that also predict job performance. It is unlikely that any national tests will be able to provide as much information about a student's job-relevant skills as could be provided by a simple repackaging of existing assessments and experiences. The benefits of more job-relevant assessments—as a signal to employers that will provide incentives for students to achieve, as a reduction in the selection costs for employers, as a way of strengthening relations between colleges and employers—are important enough for colleges to begin making changes now.

Appendix A

Job Analysis Systems and KSAs

Hay Associates Profile System: The Hay Group is a large compensation consulting firm that performs job analyses on jobs covering some 2 million workers in the United States. Its job analyses focus on three areas:

1. ***Know-how***—concerns the techniques and procedures required by jobs. Examples of know-how are professional skills, such as accounting or engineering, and general management skills, such as designing plans. More difficult jobs have associated specialized and technical skills and greater breadth required across skills.

2. ***Problem solving***—refers to the thinking demands made by jobs. Routine, repetitive tasks fall at the lower end of this scale, while those that have only abstract definitions, requiring adaptive abilities, fall at the upper end.

3. ***Accountability***—refers to the freedom to act that is accorded to employees in a job. Jobs that offer employees little guidance and that also are associated with the potential to have a large impact on the organization score high on this scale.

The Position Analysis Questionnaire (PAQ): The PAQ has been the most thoroughly researched and academically prominent of the job analysis methods.[12] The theme of the PAQ is to identify the basic behavior and aptitude requirements of jobs. The 187 items in the questionnaire can be divided into six general categories:

1. *Information*: where and how one gets information needed for the job
2. *Mental processes*: reasoning, decision making, and so forth
3. *Work output*: physical activities, tools, and so forth
4. *Relationships with others*: measures of complexity
5. *Job context*: social and physical context of work
6. *Other*: a "catch-all" category

Although the PAQ focuses on work behaviors as opposed to tasks and has sometimes been criticized in the context of differentiating jobs, it helps to identify what workers need to know across a broad range of jobs that require similar kinds of behavior.

The ability of the PAQ to identify basic work KSAs has been examined through a series of tests of the relationship between PAQ job scores and the performance of job holders on the GATBy, which is perhaps the most widely used test of employment aptitude. The idea is that people gravitate toward jobs that use their skills; so these studies correlated GATBy scores of incumbents with PAQ scores for their jobs. McCormick and Jeanneret (1988, 831) summarized the results, which are strong.[13]

Private firm studies using commercial tests of intelligence and verbal, numerical, spatial, and clerical aptitude also show reasonably good correlations with the PAQ (about 0.70). What these tests show is that PAQ measures of job requirements track the characteristics held by workers in those jobs. This is not the same as establishing validity— identifying "true" requirements of jobs—but these results are consistent with a valid measure under the assumption that workers sort themselves out by job according to KSAs.

The Management Position Description Questionnaire: This questionnaire was developed by Control Data Business Advisors for use with their own managerial employees. It has, however, become popular in many white-collar organizations, in part because its focus on managerial jobs made it appear more applicable to this type of business.[14] The basic KSAs can be categorized as follows:

1. *Leadership skills*: motivation, coaching
2. *Administrative skills*: planning, allocating
3. *Interpersonal skills*: conflict management, group process skills
4. *Communications and decision making*: informtion management, analytic ability
5. *Professional knowledge*: company-specific practices, technical skills such as accounting

The Threshold Traits Analysis System: This system is a different approach that focuses explicitly on individual job holders, rather than on the jobs themselves, and examines their personality traits.[15] The traits can be broken down into *ability factors* (which are subdivided into aptitude for acquiring knowledge or skill and proficiency in skills already possessed) and *attitudinal factors* (which affect the willingness to perform at given levels). The specific traits are categorized as follows:

1. *Physical traits*, such as strength
2. *Mental traits*, such as problem-solving and memory
3. *Learned knowledge and skills*, such as communication, motivation, and adaptability
4. *Social traits*, such as influence and cooperation

Ability Requirement Scales: The Ability Requirement Scales attempt to identify generic abilities and are based on 50 item categories. Perhaps more than any of the other job analysis systems described here, the Ability Requirement Scales focus on physical and perceptual factors. *Communication skills*, *reasoning*, and *problem solving* feature heavily among the nonphysical and perceptual factors.[16]

Functional Job Analysis: This mode of analysis was developed out of the need to determine the worker characteristics required for jobs described in the *Dictionary of Occupational Titles*. The method is designed to be straightforward, and job analysts are required to make far fewer decisions on their own than is the case in most methods. The scales used in the Functional Job Analysis fall into six categories:

1. *Data functions*: complexity in the use of information
2. *People functions*: level of interpersonal skills demanded
3. *Functions that involve using objects*: physical requirements, typically with machines
4. *Worker instructions*: level of responsibility
5. *Reasoning development*: from common sense to abstract undertakings
6. *Mathematical development*: math skills
7. *Writing functions*[17]

The Secretary's Commission on Achieving Necessary Skills (SCANS): The SCANS is a public policy study of the particular KSAs demanded by jobs in the current economy. The Commission was charged with identifying the requirements for entry-level jobs, with the idea that once

generic job requirements were identified, they could then be used to help shape what is taught in schools. The SCANS report really amounts to a public-policy-based job analysis.

Endnotes

[1] For example, Maeroff (1991).

[2] The rationale for this situation is the difficulty of drawing any conclusions about the absence of significant effects because of the many problems that can mask significant results.

[3] Some earlier meta-analyses of grades have shown relationships between grades and performance, albeit small ones. Proponents of using grades point out that even small validity coefficients may be economically useful. Assuming that the standard deviation of performance in a particular job is equivalent to $10,000 per year (reasonable for management jobs), a validity coefficient of 0.10 for grades implies an improvement over chance of $1,000 per year in performance when using grades as a selection device, a substantial gain when measured as present discounted value. Statistical corrections made in recognition that performance criteria are often uncertain and that the range of performance is restricted by the selection process (i.e., those hired may be more similar than the overall pool of applicants) can change the validity coefficients substantially, often raising them. The American Psychological Association suggests that these corrections be reported along with the regular validity coefficients. On the other hand, these validity studies of grades typically do not report what marginal gain results from using grades as one of several predictors to determine whether even the small predictive power of grades is, in fact, the result of some other, confounding factor. It is possible, for example, that effort is what really matters for job performance, and grades are simply a proxy—a poor proxy—for effort.

[4] Klitgard (1985) has produced a review that concentrates on studies in sociology, which find that student performance explains how students get sorted into occupations, but that such performance explains little about the success within occupations. See Taubman (August 1991) for a summary of recent changes in the return to higher education.

[5] There is some evidence for this view at the high school level. Bishop (1991) finds, for example, that higher levels of competency in math reasoning, verbal, and science abilities (as measured by the Armed Services Vocational Aptitude Battery) actually received a *negative* reward from the labor market in terms of wages. The most plausible explanation for this result is that these competencies were not required by most jobs held by non-college-bound youths.

[6] Dye and Reck's (1989) survey found that grades in one's major field are better predictors; Bretz's (1989) survey found that grades explain performance better in business and education, in which students are more likely to have received training in programs specific to those fields. Howard (1986) found that graduate grades are better predictors than undergraduate grades and that grades in a specific business program (e.g., MBA) are better than masters degrees taken as a group. Weinstein and Srirvasan (1974) also found relationships between grades in MBA programs and later salaries.

[7] The payoff of a given selection test varies by employer and depends on the characteristics of selection in the absence of the test, the "base rate" (percentage of employees who succeed), and the "selection ratio" (percentage of applicants hired). Expectancy charts calculate the returns for a given test according to its validity and the employer's base and selection ratios. In general, tests offer the highest payoff when both ratios are around 50 percent.

[8] See Reilly and Chao (1982) for the relative performance of grades and Barrett and Depinet (1991) for the most successful ability test results.

[9] For example, Owens (1976) and Schneider (1976). Asher (1972) presented summary data suggesting that by some criteria, bio-data were almost twice as successful at predicting job performance as intelligence aptitude, the next best method examined. Sparks' (1983) data indicate that bio-data are far and away the best predictors of job proficiency. McDaniel, Schmidt, and Hunter's (1988) meta-analysis found that prior work experience is the best predictor of job performance. Bishop (1991) concluded that the previous five year's work experience has a bigger impact on productivity than five grade levels of math and verbal ability. This is not to say, however, that bio-data have not been criticized. Korman (1966) found that bio-data have real problems predicting managerial performance and may be inferior to other methods for such jobs.

[10] Our thanks to Marsha Cameron at the Wyatt Company, Joy Hazucha at Personnel Decisions, Inc., Charles Lee at TPF&C (Towers Perrin), Andy Rosen at Hay Associates, and Eugene R. Smoley, Jr., at Cresap (Towers Perrin) for their thoughts on the changes in managerial jobs.

[11] See Madaus (1991) for a discussion of some of the problems associated with national tests.

[12] McCormick, Ernest J. and P. Richard Jeanneret. 1988. "Position Analysis Questionnaire." Sidney Gael, ed. *The Job Analysis Handbook for Business, Industry, and Government.* New York: John Wiley and Sons, 825-842. There is also a Professional and Managerial Position Questionnaire (PMPQ), which is very similar.

[13] The assumption is that on average, current incumbents in jobs have the exact KSAs necessary to do their jobs—that there are no overqualified or under-qualified workers. This may be a reasonable assumption as long as the job analysis is based on a large number of incumbents. At the very least, the match between KSAs and requirements cannot vary across jobs.

[14] Page, Ronald C. 1988. "Management Position Description Questionnaire." Sidney Gael, ed. *The Job Analysis Handbook for Business, Industry, and Government*. New York: John Wiley and Sons, 860-879.

[15] Lopez, Felix. 1988. "Threshold Traits Analysis System." Sidney Gael, ed. *The Job Analysis Handbook for Business, Industry, and Government*. New York: John Wiley and Sons, 890-901.

[16] Fleishman, Edwin, and Michael D. Mumford. 1988. "Ability Requirement Scales." Sidney Gael, ed. *The Job Analysis Handbook for Business, Industry, and Government*. New York: John Wiley and Sons, 917-935.

[17] Fine, Sidney. 1988. "Functional Job Analysis." Sidney Gael, ed. *The Job Analysis Handbook for Business, Industry, and Government*. New York: John Wiley and Sons, 1019-1035.

References

Asher, James J. 1972. "The Biographical Item: Can It Be Improved?" *Personnel Psychology* 25: 251-269.

Asher, James J., and James A. Sciarrino. 1974. "Realistic Work Sample Tests: A Review." *Personnel Psychology* 27: 519-533.

Barrett, Gerald V., and Robert L. Depinet. 1991. "A Reconsideration of Testing for Competence Rather than for Intelligence." *American Psychologist* 46(10): 1012-1024.

Bishop, John. 1989. "Incentives for Learning: Why American High School Students Perform So Poorly Relative to Their Foreign Counterparts." *Investing in People*. Washington, D.C.: U.S. Department of Labor, Secretary's Commission on Workforce Quality and Labor Market Efficiency.

Bishop, John. 1991. "Department of Labor Testing: Seizing an Opportunity to Increase the Competitiveness of American Industry and to Raise the Earnings of American Workers." Washington, D.C.: U.S. Department of Labor, Employment and Testing Service.

Bretz, Robert D., Jr. 1989. "College Grade Point Average as aPredictor of Adult Success: A Meta-Analytic Review and Some Additional Evidence." *Public Personnel Management* 18(1): 11-22.

Cappelli, Peter. 1991. "Assessing Changes in Skill Levels for Production and Clerical Workers, 1978-1988." Philadelphia, Pennsylvania: National Center on the Educational Quality of the Workforce.

DePalma, Anthony. 1991. "How Undergraduates Can Succeed: Study Together and in Small Classes." *The New York Times* Nov. 6, B9.

Dye, David A. and Martin Reck. 1989. "College Grade Point Average as a Predictor of Adult Success: A Reply." *Public Personnel Management* 18(2): 235-241.

Ferris, K. R. 1982. "Educational Predictors of Professional Payand Performance." *Accounting, Organization, and Society* 7(3): 225-230.

Howard, A. 1986. "College Experiences and Managerial Performance." *Journal of Applied Psychology* 71: 530-552.

Hunter, J. E. 1983. "Causal Analysis, Cognitive Ability, Job Knowledge, Job Performance, and Supervisory Ratings." S. Lundy, S. Zedeck, and S. Cleveland, eds. *Performance Measure and Theory*. Hillsdale, New Jersey: Lawrence Erlbaum.

— and R. F. Hunter. 1984. "The Validity and Utility of Alternative Predictors of Job Performance." *Psychological Bulletin* 96(1): 72-98.

Klitgard, Richard. 1985. *Selecting Elites*. Boston, Massachusetts: Basic Books.

Korman, A. K. 1966. "The Prediction of Managerial Performance: A Review." *Personnel Psychology* 21: 295-322.

Maeroff, Gene I. 1991. "Assessing Alternative Assessment." *Phi Delta Kappan* 73(4): 272-281.

Madaus, George F. 1991. "The Effects of Important Tests on Students." *Phi Delta Kappan* 73(3): 226-231.

McClelland, D. C. 1973. "Testing for Competence Rather than for Intelligence." *American Psychologist* 28(1): 1-14.

McDaniel, Michael A., Frank L. Schmidt, and John Hunter. 1988. "A Meta-Analysis of the Validity of Methods for Rating Training and Experience in Personnel Selection." *Personnel Psychology* 41(2): 283-314.

Muchinsky, P. M., and D. Hoyt. 1973. "Academic Grades as a Predictor of Occupational Success Among Engineering Graduates." *Measurement and Evaluation in Guidance* 6: 93-103.

Owens, W. A. 1976. "Background Data." Marvin Dunnette, ed. *Handbook of Industrial Psychology*. Chicago, Illinois: Rand-McNally, 609-644.

Portean L. W. and L. F. McKibbin. 1988. *Management Education and Development: Drift or Thrust into the 21st Century?* New York: McGraw Hill.

Reilly, R. R. and G. T. Chao. 1982. "Validity and Fairness of Some Alternative Employee Selection Procedures." *Personnel Psychology* 35: 1-62.

Rosenbaum, J. E. 1984. *Career Mobility in a Corporate Hierarchy*. New York: Academic Press.

Schmitt, Neal, Raymond A. Noe, Ronni Meritt, and Michael P. Fitzgerald. 1984. "Validity of Assessment Center Ratings for the Prediction of Performance Ratings and School Climate of School Administrations." *Journal of Applied Psychology* 69(2): 207-213.

—. 1988. "Job Experience Correlates of Job Performance." *Journal of Applied Psychology* 73(2): 327-330.

Schneider, B. 1976. *Staffing Organizations.* Pacific Palisades, California: Goodyear.

Sparks, C. Paul. 1983. "Paper-and-Pencil Measures of Potential." George Dreher and Paul Sackett, eds. *Perspectives on Employee Staffing and Selection.* Howard, Illinois: Richard D. Irwin.

Taubman, Paul. August, 1991. *Returns to Education.* Philadelphia, Pennsylvania: National Center on the Educational Quality of the Workforce, University of Pennsylvania.

Weinstein, A. G., and V. Srinivasan. 1974. "Predicting Managerial Success of Master of Business Administration (MBA) Graduates. *Journal of Applied Psychology* 59(2): 207-212.

Wind, Jerry, and Alfred P. West, Jr. In press. "Reinventing the Corporation." *Chief Executive Magazine.*

Workforce 2000. 1984. Hudson Institute for U.S. Department of Labor. Washington, D.C.: U.S. Department of Labor.

National Center on
the Educational Quality
of the Workforce

University of Pennsylvania
4200 Pine Street, 5A
Philadelphia, PA 19104-4090